

The Award Winning

**Jimmy Carter Library & Museum**

ATLANTA, GEORGIA

## **Curriculum Guide: The President's Travels**



Unit 18 of 19:

**Fighting Tropical Disease – What Ails You?**



## Fighting Tropical Disease

### Lesson: What Ails You?

**Lesson Summary:** Students will use clues to identify tropical illnesses.

#### **Objectives:**

Students will:

- Analyze data and use clues to identify illnesses. Students will conclude that identifying and eradicating diseases is a complex process that involves identifying diseases, and solving many problems that contribute to the spread of disease.

#### **Materials:**

- Disease life cycle charts
- Clue cards with symptoms of various tropical illnesses and
- Maps of disease regions
- Map analysis chart
- Picture analysis chart
- Pictures related to diseases



## **Standards Met:**

### **Science**

**S5L4. Students will relate how microorganisms benefit or harm larger organisms.**

b. Identify harmful microorganisms and explain why they are harmful.

**S7L4. Students will examine the dependence of organisms on one another and their environments.**

c. Recognize that changes in environmental conditions can affect the survival of both individuals and entire species.

d. Categorize relationships between organisms that are competitive or mutually beneficial.

e. Describe the characteristics of Earth's major terrestrial biomes (i.e. tropical rain forest, savannah, temperate, desert, taiga, tundra, and mountain) and aquatic communities (i.e. freshwater, estuaries, and marine).

### **Epidemiology**

**SEPI1. Students will be able to understand the disease process**

c. Compare different modes of disease transmission

d. Explain how the rapid evolution of microbes results in diseases that will continue to be a public health concern.

**SEPI2. Students will identify patterns of health and disease and formulate hypotheses**

a. Identify the amount and distribution of disease within a population by person, place, and time.

### **Geography:**

**SSWG1 The student will explain the physical aspects of geography.**

a. Describe the concept of place by explaining how physical characteristics such as landforms; bodies of water, climate, soils, natural vegetation, and animal life are used to describe a place.

b. Explain how human characteristics, such as population settlement patterns, and human activities, such as agriculture and industry, can describe a place.

c. Analyze the interrelationship between physical and human characteristics of a place.

**SSWG3 The student will describe the interaction of physical and human systems that have shaped contemporary North Africa/Southwest Asia.**

d. Analyze the impact of water supplies on the growth of population centers.

**SSWG4 The student will describe the interaction of physical and human systems that have shaped contemporary Sub-Saharan Africa.**

a. Describe the location of major physical features and their impact on Sub-Saharan Africa.

b. Describe the major climates of Sub-Saharan Africa and how they have affected the development of Sub-Saharan Africa.

c. Describe the pattern of population distribution in the countries of Sub-Saharan Africa in relation to urbanization and modernization.

d. Explain how Sub-Saharan Africa's physical features have had an impact on the distribution of its population.

**SSWG4** The student will describe the interaction of physical and human systems that have shaped contemporary Sub-Saharan Africa.

h. Analyze the impact of drought and desertification on Sub-Saharan Africa.

**SSWG5** The student will describe the interaction of physical and human systems that have shaped contemporary South Asia, Southeastern Asia, and Eastern Asia.

a. Describe the location of major physical features and their impact on the regions of Asia.

b. Describe the major climates of each region and how they have affected each region's development.

c. Analyze the impact of the topography and climate on population distribution in the regions.

**SSWG7** The student will describe the interaction of physical and human systems that have shaped contemporary Latin America.

b. Describe the location of major physical features and their impact on Latin America.

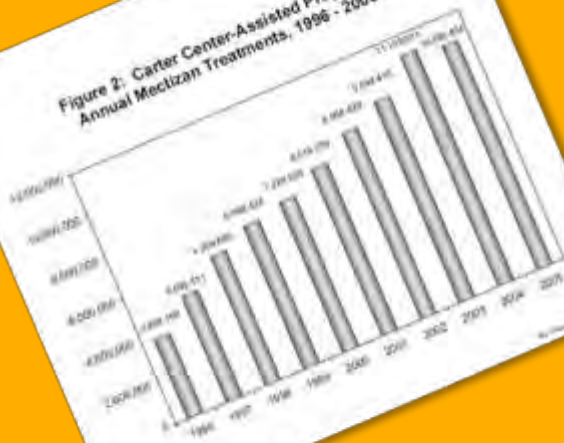
c. Describe the major climates of Latin America and how they have affected Latin America.

d. Explain how geographic features and climatic patterns affect population distribution.

**Figure 1: Carter Center-Assisted Onchocerciasis Control Programs**



**Figure 2: Carter Center-Assisted Programs: Annual Mectizan Treatments, 1996 - 2005**



### **Grade Level:**

- Upper Elementary, Middle School, High School

### **Subject Areas:**

- Science, Social Studies, Geography

### **Activity Time:**

One 50 – 60 minute class period



## **Background on Tropical Diseases**

**River Blindness:** River Blindness, or onchocerciasis, is also known as “Oncho”. This disease is one of the world’s leading cause of infectious blindness. This disease is caused by tiny black flies that transmit worms when they sting people. Adult worms embed themselves in nodules under the skin, and release large numbers of microfilaria, or microscopic worms, into the surrounding tissue. The worms move throughout the body, causing rashes, depigmentation, lesions, itching, and blindness when they die. The flies proliferate in areas with turbulent streams where they breed in water with a high concentration of oxygen. River Blindness exists occurs in Latin American and African countries. It is a source of economic problems because people leave the fertile bottomlands near streams to escape from the disease bearing flies. Prevention efforts include spraying streams to reduce the black fly population, and the use of ivermectin. Ivermectin is provided for humans by Merck & Co. under the brand Mectizan, and is the equivalent of the medicine to prevent heartworms in pets called Heartguard. Merck has donated hundreds of millions of River Blindness treatments to people in Africa, Latin America, and Yemen.

**Lymphatic Filariasis:** Lymphatic Filariasis is also known as elephantiasis or LF. This disease is a tropical parasitic infection spread by mosquitoes that causes grotesque swelling of the arms and legs. When a mosquito infected with LF larvae bites a person, the larvae are deposited into the person. The larvae migrate to the lymphatic system where they grow into adult worms. The worms cause blockages and fluid build-up in the tissues, causing the swelling for the arms, legs, and genitals. Nigeria is Africa’s most lymphatic filariasis-endemic nation. There is no cure for LF, and one common treatment is keeping wounds clean, and good hygiene practices that keep secondary infections from developing.

**Schistosomiasis:** Schistosomiasis is also known as bilharziasis or “snail fever”. It is a water-born parasitic infection that damages internal organs. The most common symptoms are blood in urine and/or feces and enlarged liver. Schistosomes are parasites that emerge from snails and live in freshwater such as ponds, dams, and rivers. When humans enter the water, the schistosomes penetrate their skin, develop into adults within the body and blood vessels, mate, and live for years. Damage to the intestines, liver, and kidneys results. This disease is endemic to 74 countries in Asia, Africa, South America.

**Trachoma:** Trachoma is a bacterial infection of the eye. Repeated infection leads to scarring and the eyelid turning inward, which is a painful condition called trichiasis. This eventually leads to blindness. The bacteria Chlamydia trachomatis, which is transmitted from person to person through contaminated cloths, and flies’ feet that land near the eyes cause this disease. Interventions for this disease include surgery, antibiotics, facial cleanliness, and environmental improvement (SAFE).

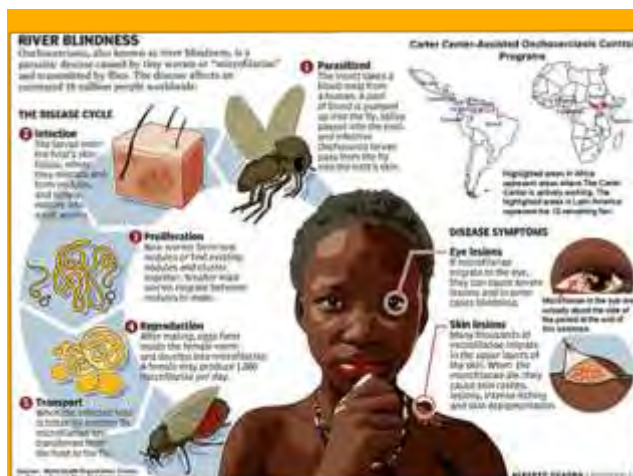
## Background on Tropical Diseases

**Malaria:** Malaria is a potentially fatal mosquito borne disease. It is transmitted through the bite of an infectious female Anopheles mosquito. Only female mosquitoes bite, and when they are feeding they can pick up malarial parasites from infected people. After seven to ten days, the mosquitoes become infectious, and can transmit the disease to another human when they bite them. 90% of all cases of Malaria are in Africa, where 1 in 10 children die if the disease before age 5. Most transmissions occur while people are sleeping, so bed netting is a common preventative measure.

**Dengue Fever:** Dengue Fever is the leading cause of illness and death in the tropics and subtropical regions of the world. It is caused by one of four related viruses that are transmitted by mosquitoes. There is no vaccine or cure for Dengue Fever. The most effective method of treatment is to avoid mosquito bites. Bed netting is a preventive measure for this disease as well as Malaria.

**Leishmaniasis:** Leishmaniasis includes the two major diseases – cutaneous and visceral Leishmaniasis. Visceral Leishmaniasis is usually fatal without treatment. It is transmitted by the bite of sand flies, and can affect humans and animals. Approximately 90% of visceral leishmaniasis cases occur in India, Bangladesh, Nepal, Sudan, Ethiopia and Brazil. 90% of cutaneous cases of this disease occur in Afghanistan, Algeria, Iran, Saudi Arabia, Syria, Brazil, Columbia, Peru, and Bolivia.

*\* For more detailed information on these tropical diseases, see the attached disease fact sheets. Videos on each of these diseases are available on the Carter Center website, and a link has been included in the resources section of these plans.*



## Assessment

- Have students use symptom and geographical clues to determine illnesses.
- Have students role play and brainstorm solutions to the problem of River Blindness

## Activity Procedures

### 1. Prepare the Activity:

- Make several copies of the symptom cards (enough so that each student has one, and there are at least two students working with each symptom card strip).
- Take each symptom card and cut the card into symptom strips. Place the cut out symptom strips in an envelope marked with the number of the symptom card on the front. Put the number of the symptom card on the envelope and on the back of each symptom strip. Write the names of the diseases on the board.

### 2. Facilitate the Activity:

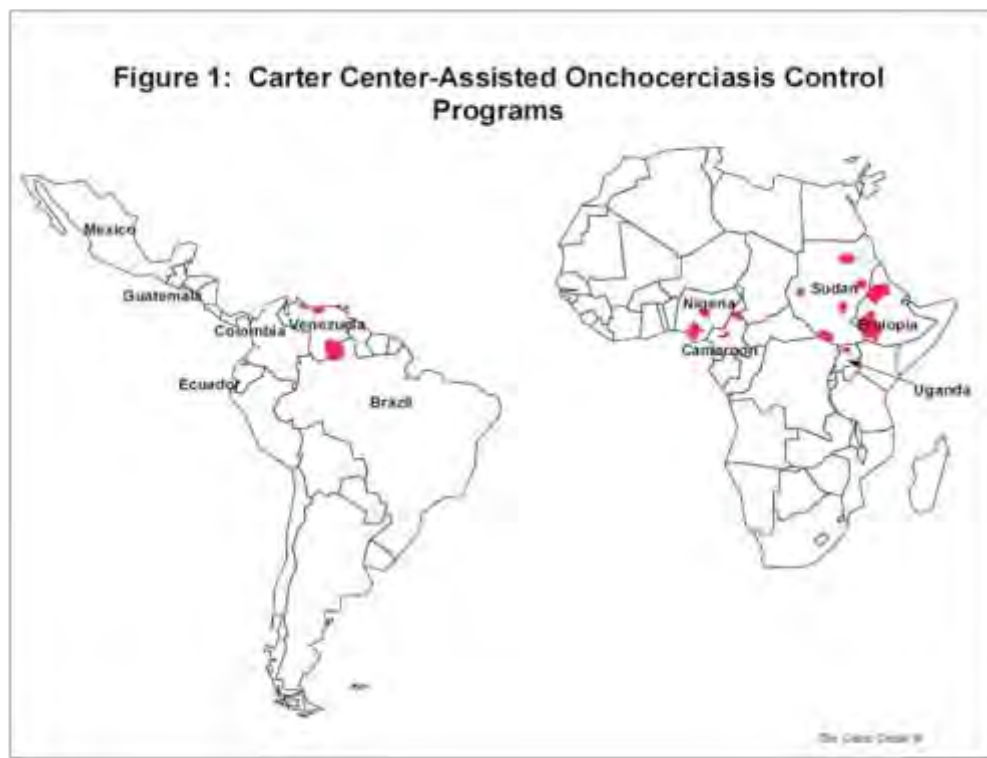
- Have students walk around the room and find the other students that have the same symptom cards and disease. When the group members have connected with each other, they should try to guess what disease they have in common.
- Have the students discuss why they think that their group has a particular disease. Have the groups research the diseases to verify their findings, and create a presentation on their disease to present to the class.

3. Have students view the maps and posters and complete the analysis documents.



## **Discussion Questions**

- Where around the world is tropical disease a problem?
- Is global warming factor in the range and spread of tropical disease?
- What are some of the challenges to eradicating tropical disease?
- What situations cause people in some communities to lack fresh water and sanitation resources?
- What can be done to aid these communities in acquiring sanitation and fresh water services?



## Spotlight on Geography

1. What countries on this map have cases of River Blindness?
  - a. What are the absolute locations of these countries?
  - b. Describe the location of these countries using relative location.
2. Complete the attached map analysis chart.
3. Choose a tropical disease and research a country with cases of one of the illness, and provide details in a country report on the five themes of geography (location, place, human environment interaction, culture, migration) in relation to that country.



## **Enduring Understandings**

- Students will understand that sanitation and access to clean water and health services are the result of access to resources that include physical resources, economic resources, and human capital and innovation.
- Students will also understand the factors that impede access to resources, and the importance of self-sufficiency and sustainability to communities.
- Students will understand that infrastructure projects such latrine building, plumbing initiatives, and sewage treatment lead to clean and sanitary living conditions in the developed world.
- Students will also understand that physical and human characteristics of a place are interrelated, and that the resources available in an area affect how humans in that area live, as well as the development of culture. Students will also make connections between resources provided by physical geography of a region and life science, health, technological innovation, and human standards of living.

## **Lesson Resources**

- Symptom clue cards
- RAFT Roles
- Maps
- Websites:
  - The Carter Center website: <http://www.cartercenter.org/health/index.html>
  - Monsters Inside Me – Animal Planet website:  
<http://animal.discovery.com/invertebrates/monsters-inside-me/parasites/>
- Interactive maps:
  - Malaria regions: <http://cdc-malaria.ncsa.uiuc.edu/>
  - Dengue regions: <http://www.healthmap.org/dengue/index.php>

# Symptom Clue Card 1

## RIVER BLINDNESS

Recently returned to the United States after living in Nigeria for two years

Itchy skin rash, nodules, and bumps under the skin

Loss of peripheral vision

Likes to hike and fish, and enjoys the outdoors

Bitten several times by small black flies

## **Symptom Clue Card 2**

LYMPHATIC FILARIASIS

Lives in Ethiopia

Frequent bacterial infections and fever

Frequently bitten by mosquitoes

Severely swollen and enlarged leg and ankle

Hard and elephant-like skin

## Symptom Clue Card 3

### SCHISTOSOMIASIS

Ten year-old Nigerian who enjoys swimming in his spare time, and whose main chore is collecting water for the household

Itchy skin rash

Fever, chills, cough, and muscle aches

Blood in stool and in urine

Abdominal pain



## Symptom Clue Card 4

TRACHOMA

Wife and mother living in a village in Ethiopia.

Village bathroom facilities and latrines host many flies that plague the village

Itchy eyelids

Eyelashes are turned inward and scratch the eye

Flies frequently land on face, especially around the eyes

## Symptom Clue Card 5

MALARIA

Recently visited Columbia.

Bitten by mosquitoes

Sensation of cold, shivering

Fever, headaches, vomiting

Body aches

## Symptom Clue Card 6

DENGUE FEVER

Recently returned from a trip to Indonesia

High Fever

Severe headache and pain behind the eyes

Joint, muscle, and/or bone pain

Rash

## Symptom Clue Card 7

### LEISHMANIASIS

Recently returned from a trip to Bangladesh.

Painless ulcers and sores on the body

Weight loss

Enlargement of the spleen and liver

Anemia



## RAFT Roles

Epidemiologist

Write a medical report on your findings after analyzing the symptoms of the disease on your clue card?

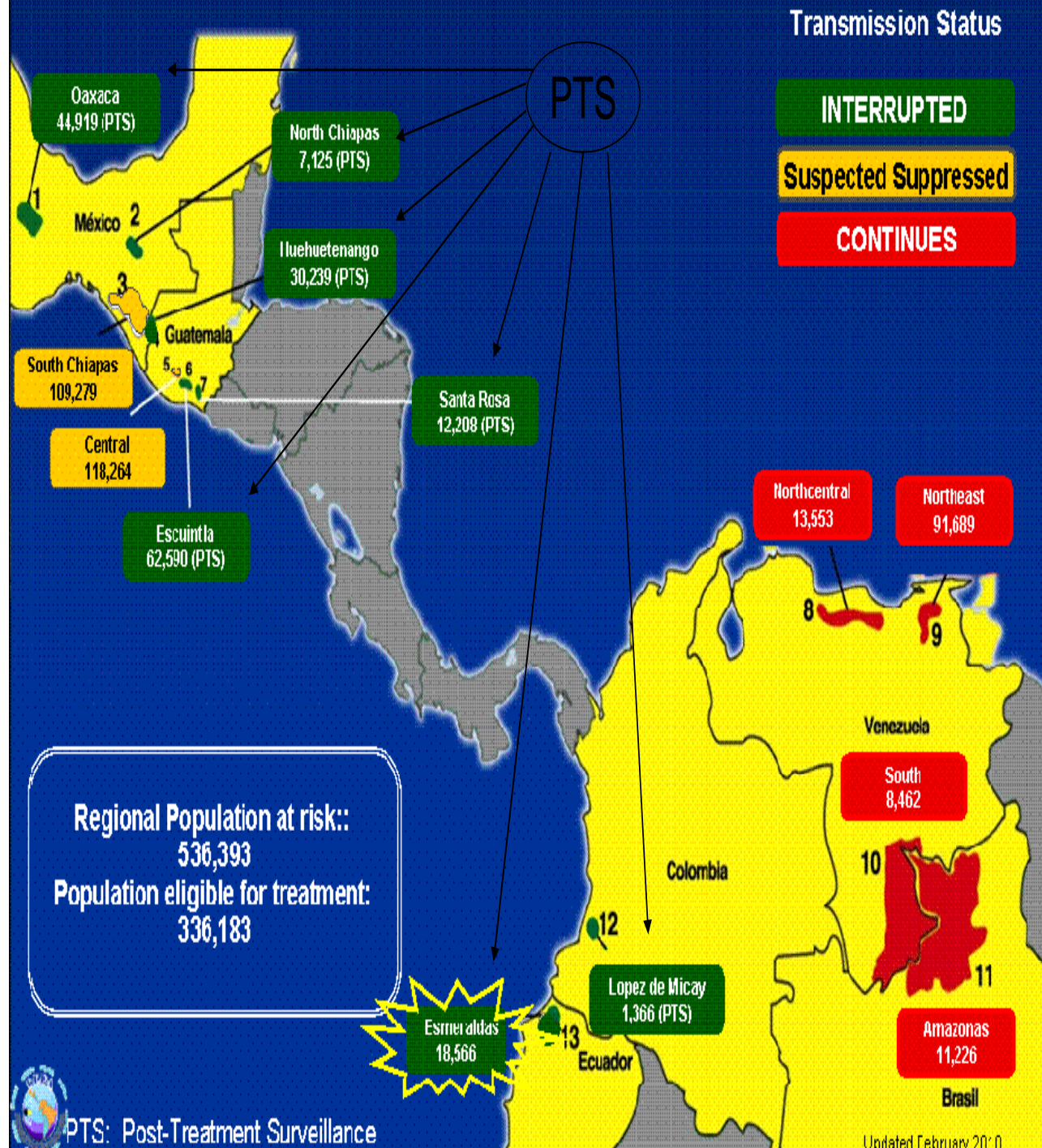
Carter Center Volunteer

Help to create a plan to aid villagers in disease eradication and prevention.

Artist creating a poster to help prevent a disease from spreading

Create a poster to inform people of the necessary steps to take in eradicating and preventing disease from their community.

# Geographic distribution and transmission status of the 13 foci of the Americas



# References and Credits

**Images and Maps:** Courtesy of the Jimmy Carter Library and Museum.

**References:**

Carter, J. 2007. Beyond the white house: Waging peace, fighting, disease, building hope. New York: Simon & Schuster.

**Additional Resources:**

**Global Warming: The Signs and the Science** (2005). PBS (Hosted by Alanis Morissette)

<http://www.shoppbs.org/product/index.jsp?productId=2121561> - Details

(Also available from <http://www.netflix.com> on demand and via mail)

**Carter Center Website:**

<http://www.cartercenter.org/health/index.html>

**Monsters Inside Me – Animal Planet site:**

<http://animal.discovery.com/invertebrates/monsters-inside-me/parasites/>

**Interactive maps:**

**Malaria regions:** <http://cdc-malaria.ncsa.uiuc.edu/>

**Dengue regions:** <http://www.healthmap.org/dengue/index.php>

**Disease symptoms and signs:**

<http://www.cdc.gov/parasites/onchocerciasis/>

<http://www.cdc.gov/parasites/lymphaticfilariasis/disease.html>

<http://www.cdc.gov/parasites/schistosomiasis/disease.html>

[http://www.cdc.gov/ncidod/dbmd/diseaseinfo/trachoma\\_t.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/trachoma_t.htm)

<http://www.cdc.gov/malaria/about/disease.html>

<http://www.cdc.gov/dengue/Symptoms/index.html>

<http://www.cdc.gov/parasites/leishmaniasis/disease.html>

## The Life Cycle of Trachoma

### INFECTING THE EYES

Flies carrying the micro-organism land on children's eyes, to feed on discharge.

### FAMILY CONTACT

Women who take care of children also get the infection.

### SPREADING OUT

Flies that breed in human feces spread the disease to others.

Dirty hands or face cloths also spread the disease.



### HOW TRACHOMA BLINDS



Infections inflame and thicken the upper eyelid.



Scarred eyelids turn inward.



The lashes scratch the cornea, leading to blindness.

Sources: The Carter Center, International Trachoma Initiative

Al Granberg/The New York Times





# TRACHOMA CONTROL PROGRAM

## ***What is trachoma?***

Trachoma is a bacterial infection of the eye. Repeated infection leads to scarring and inward turning of the eyelid—a very painful condition called trichiasis—even-  
tually causing blindness.

## ***How do you get trachoma?***

Trachoma is caused by the bacteria *Chlamydia trachomatis* and is easily spread from person to person through contaminated cloths and flies' feet that land near the eyes. Children bear the highest burden of infections with trachoma. Women are three to four times more likely to be at risk of blindness from trachoma because of their role as the traditional caregivers for children, who may unknowingly pass their infection on to their mothers.

## ***How widespread is the problem?***

Trachoma is found in the poorest and most isolated communities in 48 countries, most in Africa and the Middle East, although a few countries in the Americas and Asia also are affected.

- About 84 million people are affected by active disease.
- More than 10 million people are at immediate risk for blindness from trichiasis—the painful inward turning of the eyelashes from frequent trachoma infections. Although trachoma and trichiasis are easily preventable, the disease already has blinded more than 7 million of the world's poorest people, who depend upon their eyesight to survive.

The economic impact of lost productivity due to blinding trachoma has been estimated to be between USD 2.9 and USD 5.3 billion. If trichiasis is also taken into account, the estimated lost economic productivity is even greater at USD 8 billion.

## ***How is the disease treated and infection prevented?***

The World Health Organization endorses a series of interventions to control trachoma, known by the acronym SAFE: Surgery, Antibiotics, Facial cleanliness, and Environmental improvement.

Blindness from trachoma is irreversible, however, eyelid surgery is possible to correct the advanced stage of trachoma, trichiasis, to remove pain from the disease and prevent blindness from occurring. The Carter Center has supported approximately 30 percent of the total global output of these 20-minute surgeries, which

are performed in local communities by trained health workers.

## ***What is the Carter Center's role in trachoma control?***

To eliminate blinding trachoma, The Carter Center, in partnership with Lions Clubs, the Hilton Foundation, International Trachoma Initiative, and ministries of health, helps implement the World Health Organization's SAFE strategy in Ethiopia, Ghana, Mali, Niger, Nigeria, and Sudan.

- The Carter Center is the lead organization worldwide focusing on the environmental facet of trachoma control, having assisted the construction of approximately 1.5 million household latrines since 2002 to help control the breeding of the flies, an important source of trachoma infection.



# TRACHOMA CONTROL PROGRAM

- More than 46 million doses of Zithromax have been distributed in Carter Center-supported areas.
- Over 10,000 villages are currently benefiting from ongoing health education.
- In 2008, with technical assistance from The Carter Center, Ghana became the first sub-Saharan African country to eliminate blinding trachoma as a public health problem through implementation of the SAFE strategy.
- The Trachoma Control Program also has auxiliary benefits to public health such as improved sanitation and personal hygiene. In addition, Carter Center research has demonstrated that antibiotic distribution to treat children's active trachoma infections may reduce child mortality, since the antibiotics can help cure common childhood killers like diarrheal diseases.



# ETHIOPIA PUBLIC HEALTH TRAINING INITIATIVE

## ***What is the Ethiopia Public Health Training Initiative?***

The Ethiopia Public Health Training Initiative was launched in 1997 by The Carter Center, in partnership with Ethiopia's Ministries of Health and Education, to contribute to improving the health of underserved Ethiopians by enhancing the quality of pre-service training that health staff receive.

## ***Why is EPHTI necessary?***

The health challenges in Ethiopia are staggering: one in six Ethiopian children will not see their fifth birthday and one in eight people face acute hunger, which can lead to other health challenges.

The most common illnesses and deaths could be prevented or treated by addressing the dangerous shortage of qualified health care workers, especially for underserved rural populations.

## ***What makes EPHTI unique?***

Many health programs around the world are designed for broader regions and then instituted in different countries with little regard for their unique cultural diversity. The underlying assumption of the Ethiopia Public Health Training Initiative is that Ethiopians fundamentally know the best way to deliver public health care to Ethiopians. The program has forged unique working relationships with the Ministries of Health and Education, as well as seven Ethiopian partner universities and hospitals.

International experts work side by side with Ethiopian teaching staff to train

health center teams and to develop learning materials based on Ethiopian experience, so that the materials are directly relevant to the country's health challenges. In turn, health center staff train and supervise community health workers, including traditional birth attendants and community health agents.

Ethiopians have created a public health education system specifically prepared by and for themselves.

## ***What are the EPHTI partner universities?***

Since the first workshop in 1997, the initiative has grown to include seven Ethiopian university partners enabling the nation's best minds to collaborate and contribute to improving their national public health: Addis Ababa, Defense, Gondar, Haramaya, Hawassa, Jimma, and Mekelle campuses.

## ***What is the scope of the project?***

The Ethiopia Public Health Training Initiative was one notable outcome of early-1990s talks between former U.S. President Jimmy Carter and Ethiopian Prime Minister Meles Zenawi about the devastating state of public health in the country.

In 2005, EPHTI expanded its relationship with the Ministry of Health to implement the Accelerated Health Officer Training Program in Ethiopia.

The health officer is the leader of the community-based health center professional staff, and the program's objective

is to train 5,000 new health officers by 2011.

Although the initiative has focused on Ethiopia since it began in 1997, one of the long-term goals has been to share EPHTI's methodology with other countries in need of public health infrastructure.

In 2007, EPHTI held a replication conference—the first of its kind—to showcase EPHTI as an adaptable and customizable pre-service health education program for other African countries with similar health challenges and limited resources.

After witnessing firsthand the progress being made in Ethiopia through EPHTI, several other African countries have



# ETHIOPIA PUBLIC HEALTH TRAINING INITIATIVE

expressed interest in adapting EPHTI's model.

## *How has EPHTI contributed to improving public health in Ethiopia?*

Since its inception, more than 17,000 health center professionals have been trained by EPHTI-assisted universities.

More than half a million copies of nearly 230 health learning materials have been distributed to Ethiopians and other African nations to facilitate their use and adaptation in resource-limited environments. These materials also are freely available on the Carter Center's web site [www.cartercenter.org](http://www.cartercenter.org).

Classroom materials in partner universities have been augmented with US \$500,000 in computers, lab equipment, and teaching aids.

More than 2,500 Ethiopian faculty have been trained in pedagogical writing, supervisory, and reproductive health skills.

EPHTI efforts have begun to improve health care delivery for 79 million rural Ethiopians.

Since EPHTI began, life expectancy has risen from 41 years to approximately 56 years.





# GUINEA WORM ERADICATION PROGRAM

## ***What is Guinea worm disease?***

Guinea worm disease, also known as dracunculiasis, is a parasitic infection caused by the nematode (roundworm) parasite *Dracunculus medenisi*.

## ***How do you get Guinea worm disease?***

Guinea worm disease is contracted when people ingest drinking water from stagnant sources containing copepods (commonly referred to as water fleas) that harbor infective Guinea worm larvae. Inside a human's abdomen, Guinea worm larvae mate and female worms mature and grow, some as long as 3 feet (1 meter). After a year of incubation, the female Guinea worm creates an agonizingly painful lesion on the skin and slowly emerges from the body. The contamination cycle begins when victims, seeking relief from the

burning sensation caused by emerging Guinea worms, immerse their limbs in sources of drinking water, which stimulates the emerging worm to release larvae

into the water. The larvae are then eaten by water fleas. The cycle begins again when a person consumes the Guinea worm-infected water fleas.

## ***How widespread is the problem?***

In 1986, the disease afflicted an estimated 3.5 million people a year in 20 countries in Africa and Asia. Today, thanks to the work of The Carter Center and its partners, the incidence of Guinea worm has been reduced by more than 99 percent.

Guinea worm disease is found in areas of extreme poverty and incapacitates its victims for extended periods of time making them unable to work or grow enough

food to feed their families or attend school.

## ***How is the disease treated and infection prevented?***

There is no known curative medicine or vaccine to prevent Guinea worm disease, and patients do not develop immunity from previous infections.

Traditional removal of a Guinea worm consists of winding the 2- to 3-foot-long (1 meter) worm around a small stick or gauze and manually extracting it—a slow, painful process that often takes weeks. The skin lesions invariably develop secondary bacterial infections, which exacerbate the suffering and prolong the period of disability.

The best way to stop Guinea worm disease is to prevent people from entering sources of drinking water with an emerging Guinea worm and to educate households to always use household or pipe filters to sieve out water fleas carrying infective larvae.

Educating communities about Guinea worm prevention is vital to stopping the spread of the disease.

Thousands of village volunteers, who have been trained by Guinea worm health workers, are an integral part of the eradication effort, managing disease prevention activities, reporting cases, and treating patients.

Guinea worm disease is set to become the second disease in human history, after smallpox, to be eradicated. It will be the first parasitic disease to be eradicated and



# GUINEA WORM ERADICATION PROGRAM

the first disease to be eradicated without the use of a vaccine or medical treatment.

## *What is the Carter Center's role in Guinea worm eradication?*

Since 1986, through the leadership of former U.S. President Jimmy Carter and his wife, Rosalynn, The Carter Center has spearheaded the international Guinea worm disease eradication campaign, working with partners such as the endemic countries' ministries of health, the U.S. Centers for Disease Control and Prevention, the World Health Organization, UNICEF, and many others.

## *What is the process for certifying eradication of Guinea worm disease?*

The Carter Center-assisted program works with endemic communities to reach zero cases.

After transmission is interrupted in individual countries, surveillance will continue for at least three years to ensure the detection and containment of any new indigenous or imported Guinea worm cases. During this time the World Health Organization sends certification teams to assess coverage and quality of surveillance to determine whether transmission of the disease has been interrupted in that country. The certification team submits a report to the independent International Commission for Certification of

Dracunculiasis Eradication. The Commission reviews and evaluates the report and makes a recommendation to the director general of the WHO. The WHO will then issue an official certification that the country is free of Guinea worm disease.

Political will is needed at all levels to eradicate the disease in the endemic pockets of the remaining affected countries—southern Sudan, northern Ghana, eastern Mali, and western Ethiopia. Making national eradication programs work in remote rural areas requires enormous dedication and attention to detail by all supervisors charged with executing the campaign. Gaining the understanding and cooperation of the remaining affected communities is necessary to make Guinea worm disease a part of history.



# LYMPHATIC FILARIASIS ELIMINATION PROGRAM

## ***What is lymphatic filariasis?***

Lymphatic filariasis is a debilitating parasitic infection caused by thin worms that are transmitted by the bites of mosquitoes in tropical and subtropical regions of the world.

## ***How do you get lymphatic filariasis?***

An infected mosquito deposits microscopic larvae while biting a person. The larvae migrate to the human lymphatic system, where they mature into adult worms. In the lymphatic system, these worms cause blockages to the return of fluids to the circulatory system. This lymphatic blockage results in fluid collection in the tissues (most commonly the legs and genitalia), grotesque swellings, and periodic fevers resulting from frequent bacterial infections of the collected fluid.

A longstanding infection with lymphatic filariasis results in a condition called elephantiasis, in which changes in the affected limbs result in hardening that resembles elephant skin. The affected individual is often highly stigmatized in his or her community and leads an isolated and miserable existence.

## ***How widespread is the problem?***

The World Health Organization ranks lymphatic filariasis as a leading cause of permanent and long-term disability worldwide.

There are approximately 1.1 billion people in 80 countries at risk for contracting this disease and 120 million people infected worldwide. Nigeria is Africa's most lymphatic filariasis-endemic nation.

## ***How is the disease treated and infection prevented?***

Studies have demonstrated that transmission of lymphatic filariasis by mosquitoes can be halted by treating entire communities with annual doses of a combination of oral medicines. In Nigeria, where The Carter Center works, the medicines used are Mectizan®, donated by Merck & Co., Inc., and albendazole, donated by GlaxoSmithKline.

Health education and improved hygiene also help prevent bacterial infections associated with lymphatic filariasis.

Reducing mosquito bites adds a layer of prevention to stop transmission; thus, another important preventive strategy is the use of long-lasting insecticidal mosquito nets—the same nets used to control malaria. Distribution of long-lasting insecticidal bed nets is included in program efforts, helping to protect pregnant women and children who cannot take drug treatment.

## ***What is the Carter Center's role in lymphatic filariasis elimination***

In 1993, the Carter Center's International Task Force for Disease Eradication determined lymphatic filariasis could be eradicated with current tools and technologies.

Since 1998, at the invitation of the Nigeria Ministry of Health, The Carter

Center has worked in two Nigerian states—Nasarawa and Plateau—to demonstrate elimination of lymphatic filariasis is feasible on a large scale.

- With Carter Center support, more than 26 million treatments to prevent lymphatic filariasis have been provided in Nigeria, and mosquito infection rates have dropped by nearly 90 percent so far.
- In 2009, the Carter Center-assisted program in Nigeria experienced a major breakthrough when transmis-



sion of lymphatic filariasis was halted in 10 of the 30 local government areas where the Center works. This important achievement demonstrated that elimination is possible in the nation although there are still areas where transmission has not been broken.

# LYMPHATIC FILARIASIS ELIMINATION PROGRAM

The Carter Center also was part of a historic 18-month initiative to accelerate the elimination of malaria and lymphatic filariasis from the island of Hispaniola. Working with the Dominican Republic and Haiti from 2008-2009, the pilot project stemmed from a 2006 recommendation of the Carter Center's International Task Force for Disease Eradication (ITFDE) that it is "technically feasible, medically desirable, and would be economically beneficial," to eliminate these two parasitic diseases from Hispaniola.

Since then, the binational project has broken new ground in collaborations between these two countries for the betterment of public health on the entire island.

The Carter Center has pioneered the concept and implementation of integrating its lymphatic filariasis, river blindness, and schistosomiasis prevention activities on the ground to help Nigerian state ministry of health programs reach communities more efficiently.

And in Ethiopia, the Center is integrating lymphatic filariasis mass drug administration with onchocerciasis control in the Gambella region after completing mapping of lymphatic filariasis in communities where we already were working.

The success of such joint programs has demonstrated that one community-based health education and drug distribution system can support the control and elimination of multiple diseases.





# MALARIA CONTROL PROGRAM

## ***What is malaria?***

Malaria is a potentially fatal mosquito-borne parasitic disease, widespread in tropical and sub-tropical regions.

## ***How do you get malaria?***

Malaria is transmitted through the bites of infectious female Anopheles mosquitoes. Only female mosquitoes bite, and when feeding, they can pick up malaria parasites from an infected person. After a development cycle in the mosquito lasting from seven to 10 days, the mosquito becomes infectious and transfers malaria into the next human host when feeding.

Parasites injected by mosquitoes go first to the patient's/person's liver, where they grow, divide, and then re-enter the bloodstream. In some malaria species, parasites can remain in the liver and emerge later, causing relapses of the disease.

In the bloodstream, parasites invade red blood cells. They then go through cycles of multiplication, rupture of red cells, and reinvasion of new blood cells. The two to three-day cycle of rupturing red blood cells leads to the symptoms of the disease, which include periodic fevers, intense headache, and body-shaking chills.

## ***How widespread is the problem?***

Each year, malaria kills more than 1 million people, mostly children, with 350-500 million cases reported worldwide.

Approximately 90 percent of all cases of malaria are in Africa, where one child in 10 dies before the age of 5 from malaria.

Malaria predominately affects people who live, work, and sleep in unscreened

houses where mosquitoes can easily enter through open eaves and windows.

## ***How is the disease treated and infection prevented?***

Anti-malarial medications, where available, can be taken to avoid and treat infection.

Anopheles mosquitoes bite during the night so transmission occurs when people are sleeping. Bed nets have been used for centuries to provide a barrier against mosquito biting, thereby reducing the chance of exposure to malaria.

## ***What is the Carter Center's role in malaria prevention?***

The Carter Center's Malaria Control Program works in Ethiopia and Nigeria,

integrating malaria prevention activities with other health programming, pioneering village-based health care delivery systems that share resources, personnel, health education, and treatment to address several diseases at once.

In Ethiopia, the Center works in collaboration with the national malaria control program as well as the Center's in-country river blindness and trachoma programs.

The Center's programming in Ethiopia began in 2007, when, at the invitation of the national program, The Carter Center purchased and distributed 3 million long-lasting insecticidal bed nets, the balance the national program needed to reach its goal of providing free bed net protection for all 50 million Ethiopians at risk of malaria.



# MALARIA CONTROL PROGRAM

The innovative “MALTRA” weeks, in Amhara Region, Ethiopia, exemplify how malaria and trachoma control are being integrated into twice-yearly, week-long campaigns, allowing health workers to free resources for other disease prevention activities throughout the rest of the year.

The Carter Center also has been working with the Ethiopia government to improve and sustain the targeting of control efforts. In addition, the Center has assisted with new guidelines for malaria surveillance and epidemic detection to ensure that outbreaks are dealt with quickly, and the impact on public health minimized.

In Nigeria, The Carter Center integrates bed net distribution with its lymphatic filariasis and river blindness prevention activities. Since the same mosquito transmits both malaria and lymphatic filariasis in Africa, the distribution of bed nets can be used to prevent both diseases at once. Since 2004, more than 260,000 bed nets have been distributed.

The Carter Center also was part of a historic 18-month initiative to accelerate the elimination of malaria and lymphatic filariasis from the island of Hispaniola. Working with the Dominican Republic

and Haiti from 2008-2009, the pilot project stemmed from a 2006 recommendation of the Carter Center’s International Task Force for Disease Eradication that it is “technically feasible, medically desirable, and would be economically beneficial,” to eliminate these two parasitic diseases from Hispaniola. Since then, the binational project has broken new ground in collaborations between these two countries for the betterment of public health on the entire island.



# RIVER BLINDNESS PROGRAM

## ***What is river blindness?***

River blindness, also known as onchocerciasis, is a parasitic infection that can cause intense itching, skin discoloration, rashes, and eye disease and often leads to permanent blindness.

## ***How do you get river blindness?***

The parasite that causes river blindness, *Onchocera volvulus*, is spread by the bites of a small black fly that breeds in swiftly flowing rivers and streams. Many bites are usually needed for infection to occur.

## ***How widespread is the problem?***

River blindness is one of the leading causes of preventable blindness in the world and is endemic to 37 countries in Africa and Latin America.

River blindness has an enormous economic impact, preventing people from working, harvesting crops, receiving an education, or taking care of children.

## ***How is the disease treated and infection prevented?***

The Merck & Co., Inc. drug Mectizan® or ivermectin, distributed twice or more per year, can prevent the damaging effects of river blindness by killing the worm larvae that cause skin and eye damage.

- In 1987, Merck & Co., Inc. made the unprecedented decision to donate Mectizan for as long as necessary to all people affected by the disease in endemic countries.
- Mectizan is safely distributed in endemic areas by community volunteer workers.

Insecticide is sometimes used to reduce black fly populations and prevent spread of the disease. However, this process is very expensive and requires technical expertise.

Health education is used to mobilize communities' prevention and treatment distribution efforts.

Based on the findings of the 2002 Conference on the Eradicability of Onchocerciasis hosted at The Carter Center, river blindness is not globally eradicable with the current tools available.

The disease is being eliminated in the Americas and some isolated areas in Africa through semiannual distribution of Mectizan to at least 85 percent of those who need it.

In the remaining endemic areas in the world, continued annual distribution of Mectizan is keeping river blindness controlled to a point where it is no longer a public health problem or a constraint to economic development.

## ***What is the Carter Center's role in river blindness control and eradication?***

Working closely with the national programs in 11 countries in Africa and the Americas, The Carter Center, in partnership with Lions Clubs, is leading health education and Mectizan distribution efforts to control river blindness and eliminate it from the Western Hemisphere.

In Africa, in partnership with ministries of health, Lions Clubs, and the African



# River Blindness Program

Program for Onchocerciasis Control, the Center assists ministries of health to control river blindness in Cameroon, Ethiopia, and Nigeria, and to eliminate the disease in Uganda and one area of northern Sudan.

In the Americas, where river blindness has occurred in isolated areas in six countries—Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela—The Carter Center is the sponsoring agency for the Onchocerciasis Elimination Program of the Americas (OEPA), which aims to stop transmission of the disease by 2012.

Today, with proper treatment and health education, no one in the Americas will have to fear becoming blind because of river blindness.

Colombia and Ecuador are two of the first nations in the world to have halted river blindness transmission entirely through mass drug administration and health education.

The Center has assisted in the delivery of more than 128 million Mectizan treatments since its River Blindness Program was launched in 1996.

The Carter Center and its partners are pioneering opportunities to use one community-based health education and drug distribution system that can support the control or even elimination of multiple diseases. For example, in program areas of Nigeria, lymphatic filariasis, schistosomiasis, and river blindness interventions are being integrated, and in Ethiopia, river blindness activities are being paired with malaria prevention.





# SCHISTOSOMIASIS CONTROL PROGRAM

## What is schistosomiasis?

Schistosomiasis, also known as *bilharziasis* or “snail fever,” is a waterborne parasitic infection that damages internal organs, with the most common symptom being blood in urine and/or feces and an enlarged liver. It most commonly affects the health of school-age children.

There are two forms of schistosomiasis: urinary and intestinal.

An infection with schistosomiasis results in anemia, stunted growth and development of children, chronic debility, and sometimes premature death.



## How do you get schistosomiasis?

The parasite, which is called a schistosome, is a trematode worm. Schistosomes are acquired by contact with freshwater, such as ponds, dams, and rivers. During its larval stage, the parasite emerges from infected snails and swims in water until it can penetrate the skin of people in contact with the water. Once in the body, the larvae develop into adult male and female parasites, which pair and live together in human blood vessels in the intestines, liver, and bladder for years. The female parasites release thousands of eggs, some of which are passed out in the urine (in the case of urinary schistosomiasis) or feces (in the case of intestinal schistosomiasis), but some eggs remain trapped in body tissues.

*Schistosoma haematobium* (urinary schistosomiasis) damages the bladder and kidneys, which causes painful urination, blood in the urine, and abdominal pain.

*Schistosoma mansoni* (intestinal schistosomiasis) damages the intestines and liver, resulting in abdominal pain, fever, and rectal bleeding.

People living in poor rural areas with little or no access to sanitation or safe water supply are at greatest risk for schistosomiasis.

The majority of schistosomiasis infections occur among children ages 5–14, because they are traditionally responsible for water-related household chores in endemic countries and because they like to spend their free time swimming. Children shoulder the majority of schistosomiasis's

consequences, especially poor growth and impaired cognitive function.

## How widespread is the problem?

Schistosomiasis is the second most prevalent and socio-economically devastating parasitic disease in tropical countries after malaria.

The disease is endemic to 74 countries in Africa, South America, and Asia, where approximately 200 million people are infected. Nigeria is thought have the greatest number of people infected with schistosomiasis in the world.

## How is the disease treated?

The drug praziquantel, which costs US 18 cents per treatment, can reverse up to 90 percent of the damage caused by the parasites.

Worldwide, more than 500 million tablets are estimated to be needed every year to treat schistosomiasis.

## What is the Carter Center's role in schistosomiasis control and prevention?

Since 1999, the Carter Center-assisted program has been the largest initiative working in Nigeria to prevent and treat schistosomiasis through health education campaigns and the distribution of praziquantel in Delta, Nasarawa, and Plateau states.

In 2009, the World Health Organization and Merck KGaA (Germany) made a historic donation of 1.5 million praziquantel tablets to The Carter Center. The

# SCHISTOSOMIASIS CONTROL PROGRAM

donation greatly expanded the program's reach and was awarded in recognition of the Center's dramatic growth of distribution activities to accommodate WHO/Merck's 2008 donation of 1.1 million praziquantel tablets—greater than the cumulative output of the program from 1996 to 2007. As a result of these efforts, millions of Nigerians are now benefitting from schistosomiasis treatment.

For example, blood in schoolchildren's urine—a tell-tale sign of schistosomiasis infection—has been reduced by approximately 94 percent in Plateau and Nasarawa states and approximately 88 percent in Delta state.

The Carter Center and its partners are pioneering opportunities to use one community-based health education and drug distribution system that can support the

control—or even elimination—of multiple diseases. For example, in program areas of Nigeria, lymphatic filariasis, schistosomiasis, and river blindness interventions are being integrated, and in Ethiopia, river blindness activities are being paired with malaria prevention.